



# APL2 Reference Card

SX26-3738-1  
File No. S370-40

## Second Edition (December 1985)

This is a major revision of, and makes obsolete, SX26-3738-0.

This edition applies to Release 2 of APL2, Program Product 5668-899. This summary may be updated from time to time; however, the basic documentation (*APL2 Programming: Language Reference*, SH20-9227) is the authoritative source and will be the first to reflect changes. Changes are indicated by a vertical bar to the left of the change.

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## APL2 Character Set

## Primitive Functions

Symbol	Symbol Name	Monadic Function	Dyadic Function
+	Plus	Conjugate	Add*
-	Bar	Negative	Subtract*
×	Times	Direction	Multiply*
÷	Divide	Reciprocal	Divide*
	Stile	Magnitude	Residue*
⌈	Up Stile	Ceiling	Maximum*
⌊	Down Stile	Floor	Minimum*
?	Query	Roll	Deal*
*	Star	Exponential	Power*
●	Circle Star	Natural Log	Logarithm*
○	Circle	Pi Times	Circle Function*
!	Quote Dot	Factorial	Binomial*
■	Quad Divide	Matrix Inverse	Matrix Divide
~	Tilde	Not	Without
^	Up Caret		And*

\*Axis Permitted

## Primitive Functions (continued)

Symbol	Symbol Name	Monadic Function	Dyadic Function
∨	Down Caret		Or*
⊛	Up Caret Tilde		Nand*
⌞	Down Caret Tilde		Nor*
<	Less		Less Than*
≤	Not Greater		Less Than or Equal*
=	Equal		Equal*
≥	Not Less		Greater Than or Equal*
>	Greater		Greater Than*
≠	Not Equal		Not Equal*
≡	Equal Underbar	Depth	Match
ρ	Rho	Shape	Reshape
▷	Right Shoe	Disclose*	Pick
◁	Left Shoe	Enclose*	
·	Comma	Ravel*	Catenate*
∅	Circle Stile	Reverse*	Rotate*
⊖	Circle Slope	Transpose	Transpose
[]		Bracket Index	
↓	Down Arrow		Drop*
↑	Up Arrow	First	Take*
ι	Iota	Interval	Index of
ε	Epsilon Underbar		Find
Δ	Delta Stile	Grade Up	Grade Up
⊖	Del Stile	Grade Down	Grade Down
϶	Epsilon	Enlist	Member
↓	Down Tack Jot	Execute	
↑	Up Tack Jot	Format	Format

\*Axis Permitted

## Primitive Functions (continued)

Symbol	Symbol Name	Monadic Function	Dyadic Function
$\downarrow$	Down tack		Decode
$\uparrow$	Up tack		Encode
$\square AF$			Atomic Function
$\square AT$			Attributes
$\square CR$		Character Rep	
$\square DL$		Delay	
$\square EA$			Execute Alt
$\square EC$		Execute Controlled	
$\square ES$		Event Simulate	Event Simulate
$\square EX$		Expunge	
$\square FX$		Fix	Fix
$\square FA$		Name Assoc	Name Assoc
$\square FC$		Name Class	Name Class
$\square NL$		Name List	Name List
$\square SVC$		Shar Var Control	Shar Var Control
$\square SVO$		Shar Var Offer	Shar Var Offer
$\square SVQ$		Shar Var Query	
$\square SVR$		Shar Var Retract	
$\square SVS$		Shar Var State	
$\square TF$			Transfer Form

\*Axis Permitted

## System Variables

$\square AI$	Account Information	$\square PP$	Print Precision
$\square AV$	Atomic Vector	$\square PW$	Print Width
$\square CT$	Comparison Tolerance	$\square PR$	Prompt Replacement
$\square EM$	Event Message	$\square RL$	Random Link
$\square ET$	Event Type	$\square R$	Right Argument
$\square FC$	Format Control	$\square SVE$	Shared Var Event
$\square IO$	Index Origin	$\square TC$	Terminal Control
$\square LX$	Latent Expression	$\square TS$	Time Stamp
$\square L$	Left Argument	$\square TZ$	Time Zone
$\square LC$	Line Counter	$\square UL$	User Load
$\square NLT$	National Language	$\square WA$	Workspace Available

## Primitive Operators

Syntax	Name	Example
$LO/R$	Compress	1 0 0 1 1 / 'PLEAT'
$LO\#R$		PAT
$LO/[X]R$	Compress	1 0 1 / [1]3 2p16
$LO\#[X]R$	with Axis	1 2 5 6
$L LO^" R$	Each (Dyadic)	1 2 3, " 4 5 6 1 4 2 5 3 6
$LO^" R$	Each (Monadic)	p " 'TOM' 'DICK' 3 4
$LO\setminus R$	Expand	A ← 1 0 1 0 0 1 A\1 2 3 1 0 2 0 0 3 A \ 'ABC' A B C
$LO\setminus[X]R$	Expand	1 0 1 \ [1]2 3p16
$LO\setminus[X]R$	with Axis	1 2 3 0 0 0 4 5 6
$L LO.RO R$	Inner Product	R ← 2 3 p 16 L ← 2 2 p 10x14 L +.x R 90 120 150 190 260 330
$L +.RO R$	Outer Product	(1 3) +.x 15 1 2 3 4 5 2 4 6 8 10 3 6 9 12 15
$LO/R$	Reduce	+ / 1 2 3 4 5
$LO\#R$		15
$L LO/R$	Reduce	4 + / 16
$L LO\#R$	N-wise	10 14 18
$L LO/[X]R$	Reduce	3 + / [1]4 3 p 112
$L LO\#[X]R$	N-wise with Axis	12 15 18 21 24 27
$LO/[X]R$	Reduce	+ / [1]3 4 p 112
$LO\#[X]R$	with Axis	15 18 21 24
$LO/R$	Replicate	1 2 3 4 / 'ABCD'
$LO\#R$		ABBCCCDDDD
$LO/[X]R$	Replicate	T ← 2 3 p 16
$LO\#[X]R$	with Axis	2 1 0 1 / [2]T 1 1 0 3 4 4 0 6
$LO\setminus R$	Scan	+ \ 1 2 3 4 5
$LO\setminus\#R$		1 3 6 10 15
$LO\setminus[X]R$	Scan with	+ \ [1]2 3 p 16
$LO\setminus[X]R$	Axis	1 2 3 5 7 9

## Circle Functions

<i>L</i>	<i>L</i> or <i>R</i>	<i>L</i>	<i>L</i> or <i>R</i>
		0	( $1-R^2$ ) $\times 0.5$
-1	Arcsin <i>R</i>	1	Sine <i>R</i>
-2	Arccos <i>R</i>	2	Cosine <i>R</i>
-3	Arctan <i>R</i>	3	Tangent <i>R</i>
-4	( $-1+R^2$ ) $\times 0.5$	4	( $1+R^2$ ) $\times 0.5$
-5	Arcsinh <i>R</i>	5	Sinh <i>R</i>
-6	Arccosh <i>R</i>	6	Cosh <i>R</i>
-7	Arctanh <i>R</i>	7	Tanh <i>R</i>
-8	( $-1-R^2$ ) $\times 0.5$	8	( $-1+R^2$ ) $\times 0.5$
-9	<i>R</i>	9	Real <i>R</i>
-10	+ <i>R</i>	10	<i>R</i>
-11	$0\sqrt{1+R}$	11	Imaginary <i>R</i>
-12	$\star 01d+R$	12	Phase <i>R</i>

## Boolean Functions

In the following example, *L* and *R* have the following values:

Symbol Name	Function	Result
		<i>L</i> =0 0 1 1 <i>R</i> =0 1 0 1
	<i>C</i>	0 0 0 0
And	<i>L</i> * <i>R</i>	0 0 0 1
Greater	<i>L</i> > <i>R</i>	0 0 1 0
	<i>L</i>	0 0 1 1
Less	<i>L</i> < <i>R</i>	0 1 0 0
	<i>R</i>	0 1 0 1
Not Equal	<i>L</i> * <i>R</i>	0 1 1 0
Or	<i>L</i> * <i>R</i>	0 1 1 1
Nor	<i>L</i> * <i>R</i>	1 0 0 0
Equal	<i>L</i> = <i>R</i>	1 0 0 1
	$\sim R$	1 0 1 0
Not Less	<i>L</i> $\geq R$	1 0 1 1
	$\sim L$	1 1 0 0
Not Greater	<i>L</i> $\leq R$	1 1 0 1
Nand	<i>L</i> * <i>R</i>	1 1 1 0
	1	1 1 1 1

## Format (by Example) Control Characters

<i>L</i> * <i>R</i>
0-Pad zeros to this point
1-Float decorator if negative
2-Float decorator if nonnegative
3-Float decorator
4-Do not float nearest decorator
5-Normal digit
6-Right decorator ends field
7-Use next decorator to right for scaled form
8-Fill empty positions of field with $\square$ FC[3]
9-Pad zeros to this position if nonzero
.-Decimal point , -Controlled comma

## Event Type Codes

SET values	
0 0 No error	
0 1	Unclassified event
1 1	<i>INTERRUPT</i>
1 2	<i>SYSTEM ERROR</i>
1 3	<i>WS FULL</i>
1 4	<i>SYSTEM LIMIT</i> -symbol table
1 5	<i>SYSTEM LIMIT</i> -no shares
1 6	<i>SYSTEM LIMIT</i> -interface quota
1 7	<i>SYSTEM LIMIT</i> -interface capacity
1 8	<i>SYSTEM LIMIT</i> -array rank
1 9	<i>SYSTEM LIMIT</i> -array size
1 10	<i>SYSTEM LIMIT</i> -array depth
1 11	<i>SYSTEM LIMIT</i> -prompt length
1 12	<i>SYSTEM LIMIT</i> -interface representation
Syntax Error	Value Error
2 1 No array	3 1 Name with no value
2 2 Ill-formed line	3 2 Function with no result
2 3 Name class	
2 4 Invalid operation	
2 5 )CS not 0	
Implicit Argument Errors	Explicit Argument Errors
4 1 OPP ERROR	5 1 VALENCE ERROR
4 2 OIO ERROR	5 2 RANK ERROR
4 3 OCT ERROR	5 3 LENGTH ERROR
4 4 OFC ERROR	5 4 DOMAIN ERROR
4 5 ORL ERROR	5 5 INDEX ERROR
4 7 OPR ERROR	5 6 AXIS ERROR

## Access Control Vector SVC

1 x x x	Set by me require use by my partner.
x 1 x x	Set by my partner require use by me.
x x 1 x	Use by me requires set by my partner.
x x x 1	Use by my partner requires set by me.

## Access States SVS

0 0 0 0	Not a shared variable.
0 0 1 1	Set by one processor and used by second processor (initial state).
1 0 1 0	Set by first processor, not yet used by second processor.
0 1 0 1	Set by second processor, not yet used by first processor.

## Selected System Variable Values

Z+L DAT R	Attributes	
L[1] Valence (0, 1, or 2)	L[3] Exec. prop.(4 bits)	
L[2] Fix time (7 items)	L[4] Object size (CDR)	
Z+DNC R	Name Class	
Z= -1	Invalid	Z= 2 Variable
Z= 0	Unused but valid	Z= 3 Function
Z= 1	Label	Z= 4 Operator
DAI	Account Information	
DAI[1] User Ident.	DAI[3] Connect time	
DAI[2] Compute time	DAI[4] Keying time	
DTS	Time Stamp	
DTS[1] Year	DTS[5] Minute	
DTS[2] Month	DTS[6] Second	
DTS[3] Day	DTS[7] Millisecond	
DTS[4] Hour		
DFC	Format Control	
DFC[1] Decimal Char.	DFC[4] Fill for overflow	
DFC[2] Thous. indicator	DFC[5] Print as blank	
DFC[3] Fill for blanks	DFC[6] Neg. indicator	
DTG	Terminal Control Characters	
DTG[1] Backspace	DTG[3] Line feed	
DTG[2] New Line		

## Selected System Function Arguments

Z+L DFX R	Fix (with execution properties)	
L[1] No display	L[3] Ignore attention	
L[2] No suspension	L[4] Nonresource error is <i>DOMAIN ERROR</i>	
Z+L DTF R	Transfer Form	
L=1 (migration form)	L=2 (extended form)	

## System Commands

```
)CLEAR [size]
)CONTINUE [HOLD]
)COPY [libno] workspace [:[:pswrd]] [names]
)CS[0|1|2|3]
)DROP [libno] workspace [:[:pswrd]]
)EDITOR [1, 2 or name]
)ERASE names
)FNS [first [last]]
)HOST command
)IN file [names]
)LIB [libno] [:[:pswrd]] [first [last]]
)LOAD [libno] workspace [:[:pswrd]] [size]
)MCOPY [libno] workspace [:[:pswrd]] [names]
)MORE
)MSG[N] userid message
)MSG [OFF or ON]
)NMS [first [last]]
)OFF [HOLD]
)OPR[N] message
)OPS [first [last]]
)OUT file [names]
)PBS [ON or OFF]
)PCOPY [libno] workspace [:[:pswrd]] [names]
)QUOTA
)RESET [number]
)SAVE [[libno] workspace[:[:pswrd]]]
)SI
)SINL
)ISIS
)SYMBOLS [number]
)TIME
)VARS [first [last]]
)WSID [[libno] workspace [:[:pswrd]]]
```

## Session Manager Commands

For a list of session manager commands, press PF1.

## APL2 Editors

In the following paragraphs, *lines* is optional; if provided, it can be any of the following:

<i>n1, n2, ..., n</i>	Specifies lines <i>n1, n2, ..., n</i>
<i>n1-n2</i>	Specifies lines <i>n1</i> through <i>n2</i>
<i>-n</i>	Specifies lines 0 through <i>n</i>
<i>n-</i>	Specifies lines <i>n</i> through the last line

Command	Result
♀	Open/close definition
♀	Open/close locked definition
[+]	Abandon editing
[Δ <i>lines</i> ]	Delete <i>lines</i>
[□ <i>lines</i> ]	Display <i>lines</i>
[ <i>line</i> □ <i>position</i> ]	Display and position (Editor 1 only)
[ <i>line</i> ] <i>text</i>	Replace or insert

### Editor 2 only:

[ ]	Continue statement
[±] <i>expression</i>	Execute <i>expression</i>
[?] or PF1	Query PF keys
[:] or PF2	Renumber lines
♀ or PF3	Close definition
[♀] or PF6	Save definition
[+] or PF7	Scroll up
[+] or PF8	Scroll down
[τ] or PF9	Scroll to cursor
[/string/ <i>lines</i> ]	Locate text
[/string/ <i>N lines</i> ]	Locate names
[/old/new/ " <i>lines</i> ]	Replace text
[/old/new/ " <i>N lines</i> ]	Replace names
[v <i>name lines</i> ]	Put <i>lines</i> into <i>name</i>
[^ <i>name lines</i> ]	Get <i>lines</i> from <i>name</i>
[^ <i>lines</i> ]	Copy <i>lines</i>
[a]	Comment

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## Invocation Options

In the following, *size* can be in bytes, kilobytes (K), megabytes (M), or percentage (%) form.

**AISIZE** (*size*) (TSO only)

Maximum number of bytes stacked by AP 101.

**APNAMES** (*name*)

AP's not automatically available.

**CASE** (0|1|2)

Defines alphabets allowed in APL names.

**CODE** (*nnnnn*)

Specifies the type of terminal you are using.

**DATEFORM** (ISO|US|EU)

Specifies the format for time and date stamps.

**DEBUG** (*nnn*)

Alters normal recovery actions of APL2.

**DSOPEN** (*device*)

Specifies a value to be passed to GDDM.

**EXCLUDE** (*device-token*)

AP's not to be loaded into your session.

**FREESIZE** (*size*)

Minimum amount of free virtual storage.

**HIGHLIGHT** (INPUT|OUTPUT|ON|OFF)

Specifies lines to be highlighted on the screen.

**ID** (*nnnnnnnn*)

Account number associated with the current session.

**INPUT** ('*string*')

Specifies string(s) of data to be initially executed.

**LOADLIB** (*dsname...*) (TSO only)

Private *LOADLIB* for APL2 and AP's.

**PROFILE** (*name*)

Name of session manager profile to be loaded.

**QUIET**

No language processor output until prompted for input.

**SHRSIZE** (*size*)

Amount of virtual storage reserved for the SVP.

**SMAPL** (ON|OFF|TRY)

Specifies whether the session manager is to be used.

**SVMAX** (*nn*)

Maximum number of concurrently shared variables.

**SYSDEBUG** (*nnn*)

Special debugging settings for system programmers.

**TERMCODE** (*nnnnn*) (TSO only)

Specifies the type of terminal you are using.

**TRACE** (*nnn*)

Special debugging settings for system programmers.

**WSSIZE** (*size*)

Storage (region) reserved for your active workspace.

## Auxiliary Processors

### AP 100—Host System Command Processor

**Shared Variables:** Req. = 1.

**Initial Values:**

*CMS100*+'[CMS|CP1 [[370|EBCD]]'  
*TSO100*+'[[370|EBCD]]'

#### AP 100 TSO Built-In Commands

*APL AI*: Accounting information

*APL ATTACH module[parameters]*: Attach subtasks

*APL CODE [code]*: Query and define terminal type

*APL DEBUG [code]*: Query and set debug options

*APL DDI name*: File information

*APL DSI name*: Data set information

*APL LIB [n]*: Workspace names

*APL LIBS*: Library numbers

*APL QUIET*: Suppress messages

*APL QUOTA*: Returns information on limits

*APL USER*: TSO information

*APL WSID*: Active workspace identification

*APL WSNAME [[libno] wsid]*: DS name of ws

*EXEC clistname*: Invokes the CLIST

*TSO commandname*: Avoids conflicts between AP 100 built-in commands and TSO commands.

#### Return Codes:

-100 Command abended (CMS only)

0 No error

1 Command error

2 Command terminated by interrupt (TSO only)

3 Insufficient virtual storage (TSO only)

4 Insufficient shared storage (TSO only)

5 PDSI output is too large for the available buffer.  
(TSO only)

444 Invalid shared variable value

## AP 101—Alternative-Input (Stack) Processor

**Shared Variables:** Req. = 1.

**Initial Values:**

*SHR101*+'(FIFO|LIFO)'

#### Fence Requests (TSO)

*SHR101+1* Set or move the fence.

*SHR101+2* Purge the stack up to the fence.

*SHR101+0* Purge the entire stack.

#### Return Codes:

0 No error

1 Invalid initial value

12 Stack overflow (TSO)

444 Invalid shared variable value

## AP 102—Main Storage Access Processor

**Shared Variables:** Req. = 2.

**AP 102 Service Requests:**

*CTL102+0*

Obtain address of active workspace.

*CTL102+1 address length*

Obtain contents of *length* bytes from *address*.

**Protocol:** *CTL* and *DAT*

**Return Codes:**

- 0 No error
- 2 No *DAT* variable offered
- 3 Invalid service request
- 4 Invalid number of parameters on service request
- 5 Invalid *CTL* variable value
- 6 Invalid address specified in *CTL* variable
- 7 Invalid length specified in *CTL* variable
- 8 Insufficient storage

## AP 110—CMS File Processor

**Shared Variables:** Req. = 1 or 2.

**Initial Values:**

*REC110+1 fileid([*FIX*] [*U|R|W*] [*conversion*])*

*CTL110+1 fileid (CTL)*

The *conversion* can be: *APL*, *BCD*, *BIT*, *BYTE*,

*CDR*, *COD1*, *DBCS*, *EBCD*, *VAR*, 370, or 192.

**Return Codes:**

- 0 No error
- 1 File nonexistent or improper initial value
- 3 Permanent I/O error
- 4 First character of filemode invalid
- 5 Attempt to read too many records
- 6 Attempt to write too many records
- 7 Attempt to write past end of file
- 8 Attempt to read record of incorrect length
- 10 Attempt to create too many files
- 12 End-of-file read or read-only disk
- 13 Attempt of write on a full disk
- 14 Attempt to write on an unformatted disk
- 15 Attempt to write record of incorrect length to a fixed-length file
- 17 Record too large for output
- 19 Attempt to write in a full CMS file
- 22 Virtual storage exceeded
- 25 Insufficient storage
- 26 Item number invalid
- 27 Attempt to replace variable-length item with one of different length
- 443 Insufficient free storage
- 444 Invalid shared variable value
- 445 Insufficient shared memory for input

## AP 111—QSAM File Processor

Shared Variables: Req.=1 or 2.

Initial Values:

CMS: *REC111+ ' ddname [conversion]'*

TSO: *REC111+ ' ddname ([U|R|W] [conversion])'*

The conversion can be: *APL*, *BIT*, *BYTE*, *CDR*,  
*COD1*, *DBCS*, *EBCD* (or *192*), *TN* (TSO only),  
*VAR*, or *370* (or *BCD*).

Return Codes:

- 0 No error
- 1 Bad initial value or nonexistent file
- 12 End of file
- 15 Incorrect-length record on fixed-length output
- 17 Record too large for output
- 440 Error when opening file for output
- 441 Error when opening file for input
- 443 Insufficient space to process input
- 444 Invalid shared variable value
- 445 Insufficient shared memory for input

## AP 120—Session Manager Command Processor

Shared Variables: Req.=2.

Initial Values: None.

Protocol: *CTL* and *DAT*.

*CTL+ session manager command*

Return Codes:

- 0 0 No error
- 1 11 Rank of control variable >1
- 1 13 Control variable contains noncharacter data
- 1 53 Required storage unavailable
- 1 56 Shared variable quota exceeded
- 1 60 Session manager not available
- 4 *nnn* Error when command passed to session manager

## AP 121—APL2 Data File Processor

Shared Variables: Req.=2.

Initial Values: None.

Protocol: *CTL* and *DAT*

### AP 121 Service Requests

Service Request	Operation
'C fileid S'	Create a seq. file
'C fileid D'	Create a direct file
'O fileid [length ]'	Open for seq. write
'SHC fileid [length ]'	APL2-only
'SH fileid [length ]'	VS APL-compatible
'SR fileid'	Open for seq. read
'DR fileid'	Open for direct read
'DUC fileid'	Open for direct update
'DU fileid'	APL2-only
0 ,recnum	VS APL-compatible
1 ,recnum	Direct read
11 or 10	Direct write
'D fileid'	Close a file
'PS fileid size'	Drop a file
	Change file size limit

**AP 121 Return Codes:**

- 0 No error
- 1 Record not found
- 2 File contains maximum records
- 3 Attempt to write an invalid object
- 4 Invalid object read
- 5 End of file
- 6 Conflict between file type and access
- 7 Record length error
- 9 Virtual disk or VSAM library full
- 11 Defined file size limit exceeded
- 12 Invalid service request
- 23 File must be opened for direct update
- 24 Improper library reference
- 25 File already exists
- 26 File does not exist
- 28 File in use by others
- 30 File protected from this operation
- 31 Maximum number of files open
- 32 No space for I/O buffer
- 33 Data variable not specified before write request
- 34 Incorrect or missing password
- 35 Hardware error or APL2 product failure
- 36 Named file is not an APL2 data file
- 37 File size limit reduced below previous limit
- 38 Invalid record length on sequential write request
- 39 Required record length not specified
- 42 Data variable not referenced
- 50 Invalid request for this subsystem

**AP 123—VSAM File Processor**

Shared Variables: Req. = 2.

Initial Values: None.

Protocol: *CTL* and *DAT*.

**AP 123 Service Requests**

Service Request	Operation
'OR <i>ddname</i> [ : <i>pswrd</i> ]'	Open file for read
'OW <i>ddname</i> [ : <i>pswrd</i> ]'	Open file for write
'OU <i>ddname</i> [ : <i>pswrd</i> ]'	Open file for update
'OC <i>ddname</i> [ : <i>pswrd</i> ]'	Open and clear reusable file
'R'	Sequential read
'RU'	Sequential read for update
'R : <i>key</i> '	Direct read
'RU : <i>key</i> '	Direct read for update
'W'	Write a record
'W : <i>key</i> '	Write new record (relative record)
'E : <i>key</i> '	Erase a record (key sequenced or relative)
'PO[ : <i>key</i> ]'	Position record pointer
'KF'	Key feedback
'C'	Close file
'T'	Transfer data without translation (default)
'T1'	Translate to or from VS APL
'T2'	Translate to or from EBCDIC

**AP 123 Return Codes:**

- 1 12 Syntax error in request
- 1 13 VSAM file already open
- 1 15 Inappropriate VSAM open mode
- 1 16 Invalid service request
- 1 17 Key length error
- 1 18 VSAM MODCB error
- 1 19 VSAM SHOWCB error
- 1 20 Character vector required in data variable
- 1 21 Record length error in data variable
- 1 22 VSAM file not open
- 1 27 VSAM TESTCB error
- 1 32 Insufficient free storage for I/O buffers
- 1 33 No value assigned to data variable for write
- 1 42 Data variable not used yet
- 1 45 VSAM GENCB error
- 1 48 Invalid sequence of service requests

**Selected VSAM Return Codes:**

- 0 8 More than one record has the specified key.
- 4 116 File not properly closed after the last usage.
- 8 4 End of file, or specified key greater than highest key.
- 8 8 Duplicate key.
- 8 16 Record not found.
- 8 20 Record is being used by another user.
- 8 28 Data set is full.
- 8 32 Invalid relative byte address.
- 8 40 Insufficient virtual storage.
- 8 88 Sequential read without prior positioning.
- 8 96 Attempt to change key of record.
- 8 100 Attempt to change length of record on an entry sequenced or relative-record data set.
- 8 110 Attempt to open an empty file for read or update.
- 8 128 Attempt to open file not been properly allocated.
- 8 136 Insufficient virtual storage.
- 8 152 Password error.
- 8 168 Data set is in use by another job.
- 8 192 Invalid relative record number.

**AP 126—GDDM Processor**

Shared Variables: Req.=2.

Initial Values: None.

Protocol: CTL and DAT.

**AP 126 Service Request Codes**

Code	Service Request
1	Query GDDM calls
2	Set error threshold
3	Set protection key
4	Set EBCDIC translation
5	Set default buffer size
6	Set AP 126 options
7	Query AP 126 options
8	Query subset of fields for modification
9	Query current hardcopy destination
10	Issue GDDM CHART Call

**AP 126 Return Codes:**

0 0	No error
1 7	Incorrect data variable length
1 11	1 < p p CTL
1 12	Syntax error in request
1 13	Character string specified in control variable
1 14	Invalid request code specified in control variable
1 21	1 < p p DAT
1 23	Numeric data specified in data variable
1 41	Data variable not specified
1 53	Required storage not available
1 56	Insufficient space in shared variable quota
1 60	GDDM not available
1 61	Invalid service request parameter
1 62	Invalid count, code, or length value on request
1 63	Hardcopy translate table not available
1 64	Reserved page id has been requested
1 65	Invalid hardcopy destination
1 66	Hardcopy destination not available
1 67	Hardcopy destination already open
ss nnn	GDDM return code <i>nnn</i> , severity ss
4 nnn	Warning; <i>nnn</i> is GDDM return code
8 nnn	Error; <i>nnn</i> is GDDM return code
12 nnn	Severe error; <i>nnn</i> is GDDM return code
16 nnn	Abend; <i>nnn</i> is GDDM return code

## AP 127—SQL Processor

AP 127 allows you to use the Structured Query Language (SQL) on IBM DATA BASE 2 or SQL/DS. The SQL workspace is designed for use with AP 127.

<b>AP 127 Operations:</b>	<i>DAT+ 'CALL' name [values ]</i>
	Executes <i>name</i> and corresponding <i>values</i> .
	<i>DAT+ 'CLOSE' name</i>
	Closes cursor statement <i>name</i> .
	<i>DAT+ 'COMMIT'</i>
	Makes all changes since last rollback or commit permanent.
	<i>DAT+ 'EXEC' statement</i>
	Immediately executes <i>statement</i> .
	<i>DAT+ 'FETCH' name [options ]</i>
	Returns new result table data.
	<i>DAT+ 'GETOPT'</i>
	Returns values of AP 127 options.
	<i>DAT+ 'MSG' rcode</i>
	Returns error message text.
	<i>DAT+ 'NAMES'</i>
	Returns names of statements known to AP 127.
	<i>DAT+ 'OPEN' name [values ]</i>
	Opens previously prepared cursor statement <i>name</i> .
	<i>DAT+ 'PREP name statement'</i>
	Prepares <i>name</i> for later execution.
	<i>DAT+ 'PURGE' name</i>
	Removes <i>name</i> from list of active AP 127 names.
	<i>DAT+ 'ROLLBACK'</i>
	Discards all changes made since last rollback or commit.
	<i>DAT+ 'SETOPT' options</i>
	Sets values of AP 127 options.
	<i>DAT+ 'STATE' name</i>
	Yields current state of <i>name</i> .
	<i>DAT+ 'STMT' name</i>
	Yields statement <i>name</i> .
	<i>DAT+ 'TRACE' n1 n2</i>
	Yields an event trace of functions within AP 127.

**Return Codes:**

0 0 0 0 0	Normal return
0 1 0 n n	Warning message
1 0 0 n n	Error
1 1 0 n n	Transaction backout
0 0 1 0 0	Normal return, but may be more data.

## AP 210—BDAM File Processor for TSO

**Shared Variables:** Req.=2.

**Initial Values:**

*REC210+ 'ddname([FMT] [U|R|W] [conversion])'*  
*CTL210+ 'ddname (CTL')*

The *conversion* can be: *370* (or *BCD*), *BIT*, *BYTE*,  
*CDR*, *COD1*, *DBCS*, *EBCD* (or *192*), *TN*, or *VAR*.

**Return Codes:**

-nn	File too small to contain records requested
0	No error
1	Invalid initial value
12	End of file
15	Wrong-length record on fixed-length output
17	Record too large
30	Record not found
440	Error in open for output
441	Error in open for input
443	Shared variable exceeds 32760 bytes
444	Invalid shared variable value
445	Insufficient shared storage for input data
901	I/O error in reading data